

## SCIENCE BRIEF (June 2004)

# NATURAL WEATHERING AND RELEASE OF METALS FROM SOIL MINERALS

### ISSUE

Metals enter the environment due to natural processes as well as from human activities. However, near industrial sources of metals such as smelters, it had been generally assumed that these industries were responsible for the majority of metals in soils entering the biological cycles of forests. The veracity of this assumption was tested in the vicinity of two metal smelters, at Sudbury and Rouyn in eastern Canada.

### SIGNIFICANCE

**The results of this research indicate that the amounts of metals entering the biological cycles of forests in the vicinity of two metal smelters as a result of natural mineral weathering are on the same order of magnitude as those added from smelter plumes. In other words, natural processes contribute a significant portion of environmental metal loadings, even in close proximity to major industrial sources of metals. Thus, control of industrial sources will not result in zero additions of metals to the environment.**

### BACKGROUND

Metal smelters are widely regarded as major sources of metals to the environment via atmospheric deposition of particulates in smelter plumes. Natural release of metals from soil minerals is generally considered a relatively minor source of metals entering the environment in such cases, and regulatory controls emphasize the need to reduce smelter metal inputs. However, there have been no quantitative data to support, or refute this assumption. This study assessed natural metal release from soil minerals and weathered parent materials. Information on inputs from metals in smelter plumes was provided by the combined data from several other MITE-RN projects.

## **FINDINGS**

This research, carried out through the Metals in the Environment Research Network (MITE–RN) program, characterized the mineralogy and geochemistry of subsurface soils near two smelters in eastern Canada. The quantities of metals such as cadmium, copper, nickel, lead, zinc, iron, and manganese in soils released due to natural processes were estimated in a preliminary laboratory-based weathering experiment. These estimates were then compared to estimates of the amounts of metals entering the same environments from deposition of atmospheric metals originating from the smelter plumes. Both natural and industrial inputs were within the same order of magnitude. Smelter plumes are thus not the only source of metals entering the biological cycles of forests.

## **CONTINUING RESEARCH**

Ongoing research focuses on additional weathering experiments to better quantify the rate at which metals enter the biological cycles of forests. This research will allow for ecological risk assessments of metals in terrestrial environments that place industrial metal inputs into an appropriate context relative to natural processes.

## **ADDITIONAL INFORMATION**

R. Rowe, J.B. Percival and W.H. Hendershot. 2004. Natural sources of trace metals from minerals in soils near smelters in the Rouyn-Noranda and Sudbury areas. Geological Survey of Canada, Current Research 2004-H1, 9 pages.

[http://www.nrcan.gc.ca/gsc/circ/month/current\\_e.html](http://www.nrcan.gc.ca/gsc/circ/month/current_e.html)

<http://www.mite-rn.org/research/era/era.shtml>

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